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**Gilman et al.**

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(54) **ARRHYTHMIA ELECTROTHERAPY  
DEVICE AND METHOD WITH PROVISIONS  
FOR MITIGATING PATIENT DISCOMFORT**

(58) **Field of Classification Search**  
CPC .... A61N 1/3702; A61N 1/3621; A61N 1/365;  
A61N 1/36542; A61N 1/3962  
See application file for complete search history.

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(56) **References Cited**

**U.S. PATENT DOCUMENTS**

3,729,008 A	4/1973	Berkovits
3,738,370 A	6/1973	Charms
3,942,536 A	3/1976	Mirowski et al.
4,136,703 A	1/1979	Wittkamp
4,375,817 A	3/1983	Engle et al.
4,384,585 A	5/1983	Zipes
4,727,877 A	3/1988	Kallok

(Continued)

**FOREIGN PATENT DOCUMENTS**

EP	0314078 B1	10/1988
EP	0361517 A2	4/1990

(Continued)

**OTHER PUBLICATIONS**

US 5,584,866, 12/1996, Kroll et al. (withdrawn)

(Continued)

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(57) **ABSTRACT**

Apparatus and method for treating an arrhythmia in a patient  
using an electrotherapy device such as a subcutaneous  
pacing device. The device applies a series of electrotherapy  
pulses in response to the presence of the arrhythmia. Various  
provisions are disclosed for mitigating pain or discomfort as  
a result of the electrotherapy pulses.

**16 Claims, 9 Drawing Sheets**

